

## **R E M A R K S**

This amendment is responsive to the Office Action that was mailed July 14, 2005 (hereinafter "Office Action").

### **Priority**

The Office Action noted that the captioned application appears to claim the benefit of Application No. 60/251,226, filed December 5, 2000, but also noted that a reference to the earlier filed application is not included in the specification. Applicants' benefit claim was previously recognized by the Office as shown by its inclusion on the filing receipt mailed January 10, 2002. Applicants submit herewith an updated application data sheet that is in compliance with 37 C.F.R. §1.76 to perfect this benefit claim under M.P.E.P. §201.11.

### **Amendments to the Specification**

Applicants have amended the Abstract so that it contains less than 150 words. Paragraphs on pages 6 and 8 have been amended to address inconsistent references to the letters shown in corrected FIG. 1. The paragraph on page 9 beginning at line 13 has been amended to insert reference letter "P" following "a hydrogen rich gas." The paragraph on page 9 beginning at line 26 has been amended to correct the use of the trademark **INCONEL®**, U.S. Trademark Registration No. 308,200, and to recite the generic terminology of the goods associated with this registered mark. Paragraphs on pages 10 and 11 have been amended to address inconsistent references to letters shown in FIG. 2. The paragraph on page 10, beginning at line 24, has been amended to correct the reference number associated with the "exchanger" that is illustrated in FIG. 2 immediately above ATR 206. The paragraph on page 14 beginning at line 17 has been amended to correct a typographical error.

No new matter has been introduced by any of these amendments.

### **Corrections To The Drawings**

Applicants have corrected FIG. 1 by replacing the letter F with F' to refer to the process step that occurs intermediate process steps E and G. In addition, reference number 100 and an associated lead line have been added to refer to the fuel processor illustrated in FIG. 1.

FIG. 2 has been corrected by replacing reference letter "V" with the words "Vent Gas" as described on page 12, lines 8-9. Reference letter "F" has been replaced with the word "Feed" as described on page 10, lines 8-10. Reference letter "A", appearing in two locations in FIG. 2, has been replaced with "Air" as described on page 10, line 19-21 and on page 11, line 16-17. The reference number for the heat exchanger that is shown between reactors 202 and 214 has been changed to 203 as referenced on page 10, lines 19-23. The reference number for the desulfurization reactor shown immediately below shift reactor 208 has been changed to 207 as referenced on page 11, lines 7-10. Reference numbers 101 and 102 and associated lead lines have been added in reference to the first and second compartments described on page 10, at lines 8-10 and at lines 24-26.

Specific support in the specification for each of these corrections has been noted. No new matter has been introduced into the application.

### **Amendments To The Claims**

Claims 1 and 2 have been cancelled without prejudice.

Claim 3 has been amended to recite the limitations of claims 1 and 2. Support for these amendments can be found in original claims 1 and 2, in the specification as filed, including but not limited to page 2 at line 26 bridging to page 3 at line 19, on page 6, lines 15-28, and on page 10, lines 4-23, and in FIGS. 1 and 2. Claim 3 has been further amended to recite that the heat exchanger and the desulfurization reactor are disposed within a first compartment and that the ATR reactor is disposed within a second compartment.

Support for this amendment may be found in the specification as filed on page 10 at lines 4-23 and on page 10 at line 24 bridging to line 9 on page 12, and in FIG. 2. No new matter is introduced by the amendment of claim 3.

Claims 4, 6, 7, 8, have been amended to correct their dependency.

Claim 10 has been amended to recite that the first heat exchanger and the first desulfurization reactor are disposed within a first compartment and that the ATR reactor is disposed within a second compartment. Support for this amendment may be found in the specification as filed on page 10 at lines 4-23 and on page 10 at line 24 bridging to line 9 on page 12, and in FIG. 2. No new matter is introduced by the amendment of claim 10.

Claims 15-28 have been cancelled without prejudice as being directed to a non-elected invention.

#### **Claim Rejections Under 35 U.S.C. §102(b)**

Claims 1-2 and 4-7 stand rejected as being anticipated by McShea III, et al. (USP 4,863,707)("McShea"). The rejection of these claims is believed to be rendered moot by the cancellation of claims 1 and 2 and the amendment of claims 4-7 to depend from amended claim 3.

#### **Claim Rejections Under 35 U.S.C. §103(a)**

Claims 3, and 10-12 stand rejected under 35 U.S.C. §103(a) as being unpatentable over McShea, in view of Preston, Jr. (USP 4,190,641)("Preston").

McShea is relied upon by the Office for teaching a manifold (16), an autothermal reformer (42), a water gas shift reactor (58), a selective oxidation reactor (70), but is also recognized as failing to teach that sulfur compounds should be removed from a hydrocarbon fuel before coming in contact with a steam reforming catalyst. Preston is relied upon by the Office for teaching that steam reforming catalysts comprising nickel are deactivated by sulfur compounds in a hydrocarbon feed and that such sulfur compounds should be removed

before coming in contact with said nickel catalyst. It is the position of the Office that one of ordinary skill in the art at the time the invention was made would have been motivated by the teachings of Preston to modify McShea to include a hydrodesulfurizer upstream from autothermal reformer (42) for the purpose of preventing a sulfur-containing fuel from contacting the steam reforming catalyst. For the reasons that follow, Applicants believe that Preston teaches away from such a modification of McShea.

It should be noted that Preston states the following concerning sulfur containing fuels and the reforming of such fuels over a steam reforming catalyst:

Most raw hydrocarbon feedstocks contain some sulfur which, in high concentrations, poisons the nickel steam reforming catalyst *if reforming is conducted at temperatures below about 1500°F.*

With heavier feedstock, such as No. 2 fuel oil, the sulfur content of the fuel may be so high and the sulfur compound so unreactive that it is *not practical or perhaps not desirable to remove the sulfur upstream of the reactor.* Instead the reactor may be run at a much higher temperature, such as greater than 1500° F. whereby the sulfur does not completely poison the catalyst and is converted to hydrogen sulfide within the reactor.

Emphasis added. See col. 1, lines 29-32 and lines 42-50. According to Preston, even when a hydrocarbon fuel contains a high sulfur content or that sulfur content is particularly unreactive, it may not be practical or desirable to attempt to remove sulfur upstream of the reforming reactor. Rather than attempting to remove such sulfur, Preston teaches that the reforming reaction should be run at temperatures exceeding 1500° F so that the sulfur is converted to hydrogen sulfide in situ. The reforming reaction temperatures carried out in the autothermal reformer of McShea are within the higher temperature range called out in Preston. Specifically, at column 17, lines 40-42, McShea states that the effluent flowing out of the steam reforming catalyst (4) of autothermal reformer (42) will typically be at a temperature between 1600° and 1900° F. Given the higher reforming reaction temperatures taught in McShea, one of skill in the art

would not have been motivated by Preston to incorporate a hydrodesulfurizer upstream from autothermal reformer (42) in the manner suggested by the Office.

In addition, claims 3 and 10 have been amended to recite that the heat exchanger and the desulfurization reactor are disposed in a first compartment while the autothermal reactor is disposed in a second compartment. There is no teaching or suggestion in McShea and/or Preston that a heat exchanger and desulfurization reactor should be co-located within a first compartment separate apart from a reforming reactor disposed within a second compartment.

Amended claims 3 and 10 and the claims depending therefrom are not believed to be unpatentable over McShea in view of Preston. It is respectfully requested that the rejection of claims 3 and 10-12 under 35 U.S.C. §103(a) be reconsidered and withdrawn.

Claims 8-9 stand rejected under 35 U.S.C. §103(a) as being unpatentable over McShea in view of Hwang et al. (USP 4,522,894)("Hwang") and further in view of Epp et al., (USP 6,063,707)("Epp"). Claims 8-9 have been amended to depend from amended claim 3. Because no teaching or suggestion is found in Hwang or Epp of a heat exchanger for heating a hydrocarbon fuel and a desulfurization reactor for removing sulfur from the fuel should be disposed in a first compartment while an autothermal reactor for reforming the fuel should be disposed in a second compartment, claims 8-9 are believed to be in condition for allowance.

Claims 13-14 stand rejected under 35 U.S.C. §103(a) as being unpatentable over McShea in view of Preston, in view of Hwang, and further in view of Epp. Claims 13-14 depend from amended claim 10. Because none of McShea, Preston or Epp teach or suggest that a heat exchanger for heating a hydrocarbon fuel and a desulfurization reactor for removing sulfur from the fuel should be disposed in a first compartment while an autothermal reactor for

reforming the fuel should be disposed in a second compartment, claims 13-14 are believed to be in condition for allowance.

Claims 1-4 and 6-7 are rejected under 35 U.S.C. §103(a) as being unpatentable over Buswell, et al. (USP 5,360,679)("Buswell") in view of Werth (USP 5,840,270)("Werth"). Claims 1 and 2 have been cancelled and claims 4, and 6-7 have been amended to depend from amended claim 3.

Amended claim 3 recites that the heat exchanger and the desulfurization reactor are disposed in a first compartment while the autothermal reactor is disposed in a second compartment. Although Buswell discloses among other elements a steam reformer (168), a heat exchanger (152) and a desulfurization reactor (158), there is no teaching or suggestion that the heat exchanger and desulfurization reactor should be co-located in a first compartment while the steam reformer should be located in a second compartment. More generally, Applicants find no teaching or suggestion in Buswell that any of the elements of fuel processing subsystem (114) should be co-located separate and apart from reforming reactor (168). Werth is directed to the catalytic production of hydrogen from water and iron. There is no teaching or suggestion in Werth that a heat exchanger for heating a hydrocarbon fuel and a desulfurization reactor for removing sulfur from the fuel should be disposed in a first compartment while an autothermal reactor for reforming the fuel should be disposed in a second compartment. When considered separately or in combination, Buswell and Werth do not render claims 3-4 and 6-7 unpatentable. Reconsideration and withdrawal of this rejection is respectfully requested.

Claims 5 and 10-12 are rejected under 35 U.S.C. §103(a) as being unpatentable over Buswell in view of Werth and further in view of Preston. Claim 5 depends from amended claim 3 and is believed to be in condition for allowance for those reasons set forth above.

Amended claim 10 recites that a first heat exchanger and a first desulfurization reactor are disposed in a first compartment while the autothermal reactor is disposed in a second compartment. As set forth above, there is no teaching or suggestion in Buswell that the heat exchanger (152) and desulfurization reactor (158) should be co-located in a first compartment while the steam reformer (168) should be located in a second compartment. Similarly, no teaching or suggestion is found in Werth or Preston of a first heat exchanger and a first desulfurization reactor disposed in a first compartment and an autothermal reactor disposed in a second compartment. When considered separately or in combination, Buswell, Werth and Preston do not render claims 5 and 10-12 unpatentable. Reconsideration and withdrawal of this rejection is respectfully requested.

Claims 8-9 are rejected under 35 U.S.C. §103(a) as being unpatentable over Buswell in view of Werth and further in view of Epp. Claims 8-9 have been amended to depend from amended claim 3. As noted above, neither Buswell nor Werth teaches or suggests that a first heat exchanger for heating a hydrocarbon fuel and a first desulfurization reactor for removing sulfur from that fuel should be disposed in a first compartment while an autothermal reactor for reforming that fuel should be disposed in a second compartment. Because Epp also fails to teach or suggest such a structure, claims 8-9 are believed to be in condition for allowance.

Claims 13-14 are rejected under 35 U.S.C. §103(a) as being unpatentable over Buswell in view of Werth, in view of Preston and further in view of Epp. Claims 13-14 have been amended to depend from amended claim 10. As noted above, neither Buswell nor Werth teaches or suggests that a first heat exchanger for heating a hydrocarbon fuel and a first desulfurization reactor for removing sulfur from that fuel should be disposed in a first compartment while an

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autothermal reactor for reforming that fuel should be disposed in a second compartment. Because Epp also fails to teach or suggest such a structure, claims 13-14 are believed to be in condition for allowance.

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All of the stated grounds of objection and rejection are believed to have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete response has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment is respectfully requested.

Respectfully submitted,

A handwritten signature in cursive script, reading "Frank C. Turner", is written over a horizontal line.

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